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A Guide for Purposive Sampling on Twitter

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Abstract:

In this paper, we demonstrate how to use Twitter to conduct behavioral research and to guide researchers who might benefit from using this social media platform to effectively recruit survey participants. We begin by discussing the advantages researchers gain from using Twitter to recruit subjects for surveys, such as respondent anonymity, purposive sampling (which allows researchers to find respondents who participate in a topic of interest), the ability to reach respondents quickly to investigate ephemeral events, and advantages in replicating subject populations in recruitment. We offer a guide that illustrates the mechanics of using Twitter to recruit subjects and present a successful case study that illustrates how we used this technique in the real world to recruit survey participants. We provide solutions for common issues researchers might encounter when using Twitter to recruit subjects, such as nonresponse bias due to not responding to tweets in a timely manner, initial unwillingness to participate, and the inability to find appropriate survey respondents.

Keywords: Survey Recruitment, Social Media, Research Methods.

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1 Introduction

The Internet offers behavioral researchers expanded access to individuals potentially willing to participate in surveys for research purposes. Using the Internet to recruit survey participants has many benefits, such as global reach, anonymity, speed, low-cost entry barriers, expanded subject pool diversity, and improved subject pool access (Reips, 2002; Reips & Lengler, 2005; Wright, 2005). Researchers have used the Internet as a tool for economic experiments (Gregg & Walczak, 2008; Haucap & Heimeshoff, 2014; Hossain & Morgan, 2006), crowdfunding experiments (Belleflamme, Lambert, & Schwienbacher, 2014), microfinance (Flannery, 2007), media research (Mahrt & Scharkow, 2013), and health research (Nelson, Hughes, Oakes, Pankow, & Kulasingam, 2014), and research on social media platforms has addressed various research topics and continues to grow (Wilson, Gosling, & Graham, 2012).

Dillman, Smyth, and Christian (2008) and Jones (1998) offer guides to researchers interested in using the Internet as a tool to conduct research studies, while Reips and Lengler (2005) discuss ways researchers can effectively recruit study participants (e.g., through personal webpages, institutional webpages, Web experiment lists, advertisements regarding search results, metatags, newsgroups, email, banner ads, etc.). Methods such as Amazon's Mechanical Turk, which many researchers have used in their studies to recruit subjects, have yielded positive results (Mason & Suri, 2012) and offer benefits associated with subject pool access, subject pool diversity, and lower costs.

Guides for conducting research on social media platforms exist for different classes of problems. Bail (2017) developed a guide on how to conduct research with a social media plugin for Facebook and prompt users to take a survey. Mirabeau, Mignerat, and Grange (2013) discussed how to use LinkedIn as a source for survey respondents by leveraging the professionally focused social network and snowball sampling. Murphy (2017) discussed how to use Twitter to collect tweets on a particular topic by using the APIs that Twitter provides to collect and analyze relevant tweets without surveying users. In this paper, we focus on recruiting subjects for a survey by finding relevant tweets about a topic and asking the users to complete a relevant survey.

Twitter research, in particular, covers various topics (see Table 1). In their study, Zimmer and Proferes (2014) developed a typology of Twitter research by coding 382 research papers published from 2007 to 2012. Computer science, information science, and communications studies constituted the major areas; together, they accounted for 73 percent of the examined studies.

Table 1. Research Focusing on Twitter

| Research topic | References |
|---|---|
| Characteristics of conversation and collaboration | Chung & Yoon (2013), Honeycutt & Herring (2008), Huberman, Romero, & Wu (2009), Naaman, Boase, & Lai (2010) |
| Classification of users | Java, Finin, Song, & Tseng (2007), Krishnamurthy, Gill, & Arlitt (2008), Naaman et al. (2010) |
| Medical and biomedical | O'Connor, Jackson, Goldsmith, & Skirton (2014), Yuan, Bare, Johnson, & Saberi (2014) |
| Politics | Bode & Dalrymple (2016), Grossman (2009), Mellon & Prosser (2017) |
| Privacy concerns | Krishnamurthy & Wills (2008), Yuan et al. (2014) |
| Social network structure | Huberman et al. (2009), Krishnamurthy et al. (2008), Kwak, Lee, Park, & Moon (2010) |
| Trending topics & diffusion of innovation | Kwak et al. (2010) |
| User-ranking algorithms | Kwak et al. (2010) |

Many studies have demonstrated the generalizability of social media surveys. Rivers and Bailey (2009) use matched samples to show that data collected in knowledge networks (YouGov) produces similar results as other probabilistic methods such as random digit dialing telephone surveys. Paul and Dredze (2011) used two billion tweets collected between 2009 and 2010 to examine public health concerns and established geographic patterns based on Twitter profile location information. The ailment topic aspect model (ATAM+) that Paul and Dredze (2011) developed shows strong correlations (0.958) between the Center for Disease Control (CDC) influenza rates and their ATAM+ model. The ATAM+ results demonstrate that data collected on a social media platform and more established statistical-collection

methods (CDC) have a strong positive relationship and that study results from data collected on a social network site may generalize the population at large.

Recent research also suggests that populations acquired through a social network or crowdsourced mechanisms tend to produce higher-quality data than more traditional survey approaches (O'Connor et al., 2014; Weinberg, Freese, & McElhattan, 2014). As for why, one reason may be that social media networks facilitate direct communication with potential research participants, which research has shown to reduce anxiety and improve response rates (Andrews, 2012; O'Connor et al., 2014).

Regarding Twitter in particular, previous studies have compared Twitter research participant recruitment to both more traditional methods and to other social networking methods. Guillory et al. (2016) report that Twitter recruitment reached younger members of the population more reliably than online panel recruitment via email for their study on e-cigarettes. They found that younger populations recruited through Twitter as opposed to more traditional email invitations were more likely to complete surveys (Guillory et al., 2016). In addition, Gu, Skierkowski, Florin, Friend, and Ye (2016) and Yuan et al. (2014) found that using Facebook ads to recruit participants costs more money and time than using Twitter.

In this paper, we largely adapt Dillman, Smyth, and Christian's (2014) tailored design method to Twitter's affordances to conduct purposive sampling. The tailored design method uses social exchange theory as its dominant theoretical foundation. Social exchange theory connects cognitive dissonance theory, reasoned action theory, adult-to-adult communication style, influence theory, leverage-saliency theory, cost-benefit theory, and gamification theory to increase potential survey respondent's participation rates. Dillman et al. (2014) notes that all the related theories address the psychological aspect of why a person may choose to respond to a survey request and focus on affecting a person's behavioral response. Social exchange theory connects the response-encouraging theories and generates a more comprehensive method. Dillman et al. (2014) distills social exchange theory as follows: "It is that people are more likely to comply with a request from someone else if they believe and trust that the rewards for complying with that request will eventually exceed the costs of complying" (p. 24). We explain how we implemented social exchange theory on Twitter in Section 3.3.

We use social exchange theory in general and leverage-saliency theory (Groves, Singer, & Corning, 2000) in particular to motivate survey respondents to complete a survey. Leverage-saliency theory (Groves et al., 2000) states that individuals will more favorably judge a request to take a survey if they find the survey to be salient. Survey respondents who find a survey to be salient are more likely to take a survey compared to those who find it less salient. Monetary incentives can convince individuals who would not otherwise complete a survey to take the survey. That is, if individuals consider a survey salient, they will be more likely to take it without any financial incentive compared to if they find it less salient. In this guide, we help researchers find potential survey respondents who would find a survey salient and craft a brief tweet to encourage potential survey respondents into completing the survey. We discuss how we implemented leverage-saliency theory on Twitter in Sections 3.1 and 3.3.

Two types of researchers may benefit from this paper: 1) researchers who do not know about Twitter's affordances and how to use this social networking platform to conduct research and 2) researchers who use Twitter as a tool to conduct research and have interest in following best practices for recruiting subjects using Twitter. We offer potential solutions to common problems researchers might face when conducting their research on this platform, provide methods for reducing nonresponse bias by demonstrating how to respond to tweets in a timely manner, introduce methods to improve participation rates, and demonstrate how to screen tweets for appropriateness based on language and other features.

To recruit respondent populations using Twitter, researchers need to follow five key steps: 1) develop a Twitter profile, 2) screen public tweets, 3) compose tweets to be used for recruitment, 4) determine the frequency of any subsequent recruitment tweets, 5) address post-recruitment issues and concerns.

This paper proceeds as follows. In Section 2, we describe Twitter in the context of the five steps comprising our guide. In Section 3, we provide a guide for the recruitment of survey respondents on Twitter. In Section 4, we illustrate how we implemented this technique by describing each step in terms of our actual case study in which recruited Twitter users to participate in a survey that evaluated why Facebook users unfriend people. In Section 5, we discuss performance concerns, potential errors and ethical concerns. Finally, in Section 6, we conclude the paper.

2 Twitter Basics and Potential for Research

Twitter is a social network microblogging site founded in October, 2006 (Java et al., 2007), that is designed around short message service (SMS) technology. Twitter acts as a real-time tool that facilitates fluid conversations between users. Twitter defines itself as a “service for friends, family, and coworkers to communicate and stay connected through the exchange of quick, frequent messages” (Twitter, n.d.-b). A tweet refers to any message that a user posts on Twitter and may contain photos, videos, links, and up to 280 characters of text (Java et al., 2007; Krishnamurthy et al., 2008, Twitter, n.d.-b)—Twitter raised the initial 140-character limit in September, 2017 (Rosen & Ihara, 2017). Tweets exist on a variety of topics and may reference multiple participants. As of 21 February, 2019, Twitter had over 321 million monthly active users worldwide (Twitter, 2019). In 2013, users sent an estimated 500 million tweets per day (Twitter, 2014). Researchers have estimated that eight percent of its accounts are private; thus, most appear to be public (Cha, Haddadi, Benevenuto, & Gummadi, 2010). As of 31 December, 2018, Twitter had “66 million monthly active users (MAUs) in the United States and 255 million average MAUs in the rest of the world” (Twitter, 2019).

Twitter uses the terms “follow” and “follower” refer to users who subscribe to other users’ tweets (i.e., A follows B when A subscribes to tweets from B; thus, A is a follower of B) (Java et al., 2007). In general, the relationship does not require agreement in the dyad for A to follow B; that is, B does not need to grant permission to A for A to follow B under the default privacy settings (Kwak et al., 2010). Only 21 percent of the relationships on Twitter are reciprocal; in this case, reciprocity means that, when A follows B, B follows A (Kwak et al., 2010). Twitter users adopt the default privacy settings 99 percent of the time, which makes the platform more open than many other social networks (e.g., Facebook) (Krishnamurthy & Wills, 2008).

Twitter’s help center includes instructions for tweeting (posting a tweet, posting replies and mentions, sharing a tweet, retweeting, deleting a tweet, and liking a tweet), searching (finding tweets from friends, businesses and users, and topic searches), discovering tweets (finding people, connecting and highlights), sending direct messages (the private side of Twitter), and customizing the experience (security-related tasks). Users can tag text in tweets with a hashtag (i.e., #) to allow others to locate tweets about certain topics (i.e., searching for “#cats” would show tweets that users have tagged as relating to cats) (Twitter, n.d.-a). Users can also send messages to another specific user (or users) with an “@reply”. A reply is a response to another user’s tweet that begins with “@<username>” and will show up in the recipient’s notifications area. Using the Twitter interface or a variety of other services that work with Twitter data (e.g., TweetDeck), Twitter users can see messages and the users who sent them.

Twitter uses character constraints to encourage short posts, which lowers how much time and effort users need to invest to generate content (Java et al., 2007). Java et al. (2007) describe four types of posts found on Twitter: daily chatter, conversations, information/URL sharing, and news. According to their study, daily chatter posts describe a person’s current activities and constitute the most common type of post on Twitter. Conversations refer to directed messages from one user to another through the @reply mechanism and comprise 21 percent of posts. Posts that share information/URLs comprise 13 percent of posts. Finally, news posts and comments on the news was the fourth most common tweet category.

Java et al.’s (2007) categorization of Twitter users demonstrates the platform’s general viability for recruiting survey respondents for behavioral research. Since Twitter users talk about themselves a lot (meformers) and discuss what they do (daily chatter), Twitter offers researchers insight into details about individuals’ daily lives and facilitates purposive recruiting strategies. Furthermore, Twitter’s @reply mechanism can uniquely benefit recruitment in that users may be more likely to perceive a recruitment tweet that they receive through the @reply mechanism as targeting them directly based on their specific tweets rather than as spam. Twitter states that its competitive advantage relies on the “quality, quantity and real-time nature of the content”; as such, researchers interested in understanding current events would be well-advised to use the platform as a means of gaining timely insight into ephemeral phenomena.

Significantly, Twitter offers researchers the ability to screen (search) and select tweets that meet a specific area of interest (Andrews, 2012) and to sync survey topics with particular users’ interests (according to their tweets) (Russell, 2013), which can improve purposive sampling outcomes. In purposive sampling, one selects respondents based on certain criteria, which includes both judgment and quota sampling techniques. Judgment sampling prioritizes participants who meet identified criteria and suits research in its early stages when researchers make a selection based on screening criteria. Quota sampling improves a

sample's representativeness by ensuring that researchers obtain relevant characteristics in sufficient quantities (Cooper & Schindler, 2008; Smith, 1983).

Social media users in general and Twitter users in particular tend to be younger and more educated than the general population (Mellon & Prosser, 2017). Approximately 24 percent of Internet users (21% of all U.S. adults) use Twitter according to a Pew Research Center Report (Greenwood, Perrin, & Duggan, 2016). More highly educated users use Twitter more often than other educational groups: approximately 29 percent of people with college degrees, 25 percent of users with some college, and 20 percent of users with high school or less use Twitter. It has relatively similar usage rates in urban, suburban, and rural areas (26%, 24%, and 24%, respectively). When demographics on a platform do not represent a population, then researchers can control for those measures using statistical techniques (e.g., quota sampling and post-stratification) (Mellon & Prosser, 2017), redefine the target population, or acknowledge possible gaps in coverage (Groves et al., 2004). Despite the differences in the general population and population on social networking sites, several studies have demonstrated the generalizability of social media surveys (Rivers & Bailey, 2009; Paul & Dredze, 2011; O'Connor et al., 2014; Weinberg et al., 2014; Andrews, 2012).

Twitter offers researchers access to publicly accessible messages that cover a wide variety topics that often reflect current events and trends (Kwak et al., 2010). As such, Twitter offers researchers interested in ephemeral phenomena speedy access to appropriate survey participants. Purposive sampling on Twitter enables researchers to recruit people with recent experience in a specific area of interest. Such participants can benefit researchers in two ways: 1) they may provide more accurate responses because they can better recall an event (Dillman et al., 2008) and 2) they may be more willing to participate in a relevant survey due to their current interest in the topic.

Twitter has other benefits as well. First, because individuals around the entire world use Twitter, researchers can use it to investigate and compare different populations around the world (see Appendix B). Second, disenfranchised, stigmatized, or otherwise difficult-to-reach user populations may be more willing to participate in related research projects since Twitter can help users maintain their anonymity (O'Connor et al., 2014; Yuan et al., 2014). Finally, researchers can also leverage the publicly accessible nature of Twitter social media conversations (as opposed to the closed communication that characterizes Facebook) to replicate subject populations in recruitment.

3 Guide to Conducting Twitter Recruitment

In this section, we discuss five steps to recruiting subjects on Twitter. In Section 3.1, we discuss how to develop a Twitter profile (covers account name, profile picture, geographic location, brief description, links, followers, accounts that are followed, lists on which the account appears, historical tweets, biography). In Section 3.2, we discuss how to screen public tweets (covers search terms, synonyms, retweet concerns). In Section 3.3, we describe how to compose tweets for recruitment (covers the structure of a recruitment tweet). In Section 3.4, we discuss how frequently to recruit (covers how frequently to screen tweets, send recruitment tweets, and respond). Finally, in Section 3.5, we discuss post-recruitment issues and concerns (covers answers to questions from potential participants regarding the survey, responses to statements of thanks, and general posts directed to the recruiter).

3.1 Developing a Twitter Profile

Profiles on social media sites allow social networking site users, members, or platforms to construct public (or semi-public) online identities (Ellison & Boyd, 2013, Kane, Alavi, Labianca, & Borgatti, 2014). Twitter profiles include several identifying components (though do not have to include them all), such as account name, account owner's name, a profile picture, geographic location, a brief description about the person or account, URL links, an articulated list of followers, accounts the user follows, lists on which the account appears, historical tweets, a biography, a list of friends, interests, or photos.

A Twitter profile serves as the source of any recruitment tweet or message that researchers send to potential survey takers, and anyone who receives a request can see the profile. Researchers may choose to create a profile specifically for a recruitment campaign or may leverage an existing profile for recruitment. Researchers may include some or all of the following intention-revealing elements in a profile they create specifically for a campaign: an account name that describes the purpose of the recruitment, a link to a website associated with the topic or the researchers, photos to aid recruitment, or information

about the survey itself. Researchers might also choose to leverage their own existing profiles as, for example, Marwick and Boyd (2011) did to recruit survey respondents for their study on context collapse.

Researchers should devote careful attention to developing a Twitter profile for recruitment purposes. The profile should follow the platform's conventions to demonstrate authenticity. In this sense, existing profiles can prove beneficial because they have a history of followers and posts and, thus, may seem more legitimate to other users; however, researchers can often better customize profiles they create themselves in order to increase participation in a survey. By choosing the right photos, links, and affiliations, researchers may help users develop confidence in the validity, trustworthiness, and importance of the account, survey, and recruitment tweet(s), which will hopefully increase survey-completion rates. Once researchers have set up the profile, they can begin screening and recruitment.

3.2 Screening Public Tweets

Researchers can use Twitter's search mechanisms to evaluate whether users have discussed their area of interest on the platform and to determine whether Twitter would be a suitable platform for their recruitment needs before beginning a study. Twitter provides several publicly available application programming interfaces (API) that enable one access to its data stream (Twitter, n.d.-c): a standard (public) stream, which allows one to follow specific users and topics for the last seven days; a premium stream (last 30 days); and enterprise access (last 30 days or access to tweets since 2006 depending on the service level)(Twitter, n.d.-d). The service levels can range from a portion of tweets to complete data coverage in real time. However, the different options have tradeoffs in availability and cost (Morstatter, Pfeffer, Liu, & Carley, 2013). Twitter changed from site streams to user streams in August, 2018, in its API (Twitter, 2018a). In doing so, it provided three account activity API versions for developers: premium (sandbox), premium, and enterprise. The changes affect how often a user can update their timeline and obtain tweets. Twitter made these changes to reduce the amount of spam on the platform by enforcing stronger registration requirements (Twitter, 2018b). The changes reduce the rate limits for post calls made to the service (e.g., users can make only up to 300 tweets and retweets per three hours with the standard API endpoints).

Twitter's searching APIs include the ability to search for keywords, emojis, and exact phrases that specific users have generated, received, or retweeted, URL references, hashtags, usernames, languages, places, countries, geolocation, and so on (Twitter, n.d.-d). One can collect Twitter posts with packages such as *rtweet* for the statistical platform R and *Tweepy* for the programming language Python. One can use *rtweet* to filter search queries in additional ways (e.g., exclude retweets, quotes, replies, verified users and news articles, or tweets with media). The query produces tweets and users in a data structure. Further, *rtweet* will make a subsequent call to receive a more complete list of results when a rate limit blocks additional results. To recruit subjects for their survey, Vaccari et al. (2016) adopted an automated approach that screened tweets and recruited users via a script. Applications using the API can help users sort and filter results sets with automation. Twitter provides similar filtering options in its advanced search graphical user interface (Twitter, n.d.-c). Automated systems can ensure that one contacts a user only once by removing any additional tweets from a user from the data collection and managing account lists more effectively.

Once researchers have established the platform's suitability, they can begin the recruitment process by screening tweets for certain terms that fit their research project in terms of suitability and language issues. After locating appropriate users, they should send an @reply to these users and request that they take a survey. Researchers may need to use multiple terms when screening users for a particular topic. For example, researchers may use the terms "president" and "Trump" as search terms to find tweets about U.S. President Donald Trump. However, they should exclude tweets that do not concern the U.S. president (e.g., the president of a company or the president of a different country) or that use the word "trump" in another way. Depending on the type of survey that researchers conduct, they may also need to exclude tweets with the incorrect tone. For example, someone may say, "Donald Trump will bring to the presidency what the early leaders of America did: fake hair" (Lee, 2015). While this tweet concerns President Trump, it clearly expresses a joke. Exclusion policies in screening may include inappropriate posts, jokes, and so forth.

When screening for tweets, researchers need to determine if the platform has enough tweets to meet sample size requirements. Hair, Black, Babin, and Anderson (2014) used five heuristics to determine a proper sample size for structural equation modeling: 1) multivariate normality, 2) estimation technique, 3) model complexity, 4) amount of missing data, 5) average error variance. For multivariate normality, Hair et

al. recommend approximately 15 respondents for each estimated parameter. For the estimation technique, they recommend approximately 50 respondents for maximum likelihood estimation samples; however, they note that researchers may occasionally need approximately 200 samples. For instance, complex models may need more samples to increase the solution's stability. Missing data can reduce the number of cases available. Average error variance with low communalities (less than 0.5) requires larger sample sizes. Hair et al. (2014) provide general guidance as well: they suggest that researchers require approximately 100 samples for five or fewer constructs with communalities greater than 0.6 and as much as 500 samples for a large number of constructs with lower communalities

Since users can retweet tweets, researchers should determine whether they should include them (particularly retweets that many people retweet) in their study. Retweeting resembles email forwarding in that a recipient (or reader) forwards the message to someone else (Boyd, Golder, & Lotan, 2010). A user who retweets a tweet may have a weaker connection to the original content even if it resonates with the user enough to retweet it. Thus, that user may represent a poor recruitment prospect. Boyd et al. (2010) note that people retweet for many reasons (e.g., to amplify a message, for entertainment, to add additional content, agreement, etc.). A person with a large following may generate millions of retweets (DeGeneres, 2014). Recruiting survey respondents through retweeted messages may be appropriate in some cases, but it will generally be more productive to respond to someone who tweets about a topic of interest and recruit them to a survey about that topic than to recruit someone who simply retweeted a message that others already retweeted a large number of times. The recruitment method focuses on helping researchers find potential survey respondents who find the recruitment message salient.

Reducing the number of recruitment messages may increase the coverage error (a negative result) and may reduce the nonresponse error and measurement error (both positive results). For instance, researchers may increase the coverage error every time they do not send a message to a potential survey respondent because doing so increases the difference between the sample members and the population. Researchers may reduce the nonresponse error when they decide not to include a potential survey respondent who may be less likely to take the survey (e.g., retweets and jokes) because that respondent may find the survey less salient. Leverage-saliency theory states that individuals who find a survey more salient will be more likely to respond to a survey. Researchers may reduce the measurement error when they send a survey only to respondents who find it relevant because such respondents may give more accurate answers to survey questions. Applying social exchange theory to the same inclusion issues may also guide survey designers to similar conclusions. If researchers increase the rewards that they give individuals for taking a survey or reduce the costs they incur to do so, then individuals will participate more in the survey. Screening and including the most relevant members on a social networking site platform can help reduce non-response error and measurement error but may increase coverage error.

Researchers may consider other aspects beyond tweet content itself to determine inclusion. The Twitter profile often contains information such as join date, links, whether Twitter has verified the account, lists that the user is on, time zone, number of photos, geolocation, number of tweets sent, number of followers, number of users followed, the date the tweet was created, number of retweets, and more.

3.3 Composing Tweets for Recruitment

According to Dillman et al. (2008), emails for survey recruitment should be short and to the point to increase the likelihood that individuals will completely read them. They also propose that such emails should include: researchers' university sponsorship logo and header, an informative subject heading, the current date, an appeal for help, a statement as to why researchers selected the survey respondent, survey's usefulness, directions on how to access survey, a clickable link, an individualized ID (for tracking), a statement of confidentiality and voluntary input, researchers' contact details, an expression of thanks, and an indication of the survey respondent's importance. While we modeled our recruitment tweets on Dillman et al. (2008), we adapted them to Twitter's character limitations. As such, our recruitment tweets included six components (see Table 2): 1) the @reply mechanism (i.e., we sent the message as a direct message through that mechanism), 2) a sentence to indicate we had recognized the user's tweet about a topic, 3) a statement that we had a survey, 4) a link to the survey site, 5) a note about the importance of the user's input, and 6) a statement about the context for the recruitment.

Table 2. Anatomy of a Recruitment Tweet

| 1 | 2 | 3 | 4 |
|---|---------------------------------|------------------|----------------------|
| @x | I saw your tweet about <topic>. | I have a survey: | http://<survey site> |
| 5 | | | 6 |
| Your input is very important. | | | <Role> |
| <ol style="list-style-type: none"> 1) We made the recruitment tweet with the reply mechanism (i.e., we replied to a tweet they had tweeted), so the user could trace it back to the tweet that they sent.. 2) We set the recruitment tweet to trigger based on the content in a person's tweet. 3) We mentioned we were conducting a survey on the topic that the person tweeted about. 4) We did not shorten the survey (via bit.ly, TinyURL, etc.) to increase individuals' confidence in the link's safety. 5) The recruitment tweet mentioned that we found the Twitter user's input and, by implication, the Twitter user important. 6) We mentioned that we conducted the research for academic rather than marketing purposes. | | | |

We relied on Twitter's affordances and embedded several features into our recruiting tweet to maximize our recruiting effort's effectiveness. For example, when one uses the @reply mechanism, one establishes a relationship between the sent tweet and the reply so that recipients can identify the original tweet, recall their personal interest in the survey topic, and discern why we selected them to participate in the study. The platform allows recipients to view the recruiter's profile so that they can make judgments about authenticity based on factors such as publicly accessible messages and relational ties (following and followers) and, perhaps, by traversing those ties. Once users received the recruitment tweet, they could click on the link and go to the survey site, which included a cover letter that described the survey in detail. Though a shortened version of the URL link would reduce the number of characters we could use for the message itself, we included the long form of the link to increase confidence in its safety and validity and to amplify the sense that we found users and their input important.

Tweet from Twitter user X to Twitter user Y:

@Y I like <topic>. I am the world's biggest fan.

Tweet sent to user X to recruit the user to a survey:

@x I saw your tweet about <topic>. I have a survey <http://surveysite.com/s/relatedSurvey>
Your input is very important. <Role>

3.4 Frequency of Recruitment

One needs to screen tweets frequently to send responses soon after users create them. We chose to use humans for this task. The process is relatively straightforward: search for keywords, screen for language and appropriateness, send an @reply to the tweet, and respond to any @replies sent to the recruitment Twitter account. One can manually screen tweets or use automated methods with the APIs that Twitter provides. Researchers should monitor the Twitter account so that they can quickly reply to messages from potential survey respondents. By doing so, researchers can interact more with potential survey participants and answer questions they may have about the survey. Further, answering @replies sent to the research Twitter account after sending recruitment tweets moves personalized tweets to the top of the Twitter account, which gives them increased visibility. Unique tweets at the top of the account mean that any survey recruit coming to the research profile to find out about the account will see individualized messages that an actual person sent rather than an automated system. In this way, researchers can develop credibility with potential respondents.

3.5 Post-recruitment Issues and Concerns

Quickly responding to post-recruitment concerns can improve a person's willingness to participate in a survey. Twitter offers some anonymity (via handles) and engenders a sense of real-time personal communication. These factors may encourage individuals who receive recruitment requests to follow up with questions they may have, and, if they receive satisfactory answers, they may be more willing to complete a survey. Effective recruitment language and quick and appropriate responses to questions can give survey respondents the feeling that researchers value their time and effort. Answering questions regarding whether and how researchers will use the research, if the research is real, if the survey is safe,

and general statements about the study in relation to respondents' interests may also increase participants' willingness to complete the survey.

Twitter respondents appear to have a cultural expectation that a tweet sent through the @reply mechanism will generate an appropriate response from the receiver. If a Twitter account has a tweet history but potential survey participants can see only recruitment tweets, they may believe that the recruitment tweets lack authenticity and that an automated response mechanism (bot or robot) delivered them. Therefore, researchers need to introduce a sense of human authenticity into responses. By responding to questions immediately after sending recruitment messages, for example, researchers can help ensure that individuals find historical tweets more personal and that the account appears more authentic and *human*. By responding to tweets that simply say "thanks", researchers can also show potential respondents that other individuals found the survey helpful or genuine and that they recognize and appreciate input. Varying tweet responses to such simple statements can be useful for indicating that a person is sending personalized responses (and, therefore, that the person values the respondent's participation and time).

4 Case Study Implementation

4.1 Twitter Profile Used for Case Study

We generated a Twitter profile for this study using the first author's real name, location, biographical information, and photo to screen and recruit survey respondents. We show a snapshot of the profile on the last day we recruited for this study in Figure 1. We generated the account specifically for research purposes, so it had no followers at the start of the recruitment period. The recruitment account itself followed one user to indicate that the account was genuine. We subsequently followed other Twitter accounts so that users could message the recruitment account privately through direct messages. Participants could ask for more direct and private access, which we granted. We chose an intention-revealing name—UnfriendStudy—for the account name so that users could deduce its intention based on its name alone. The account listed first author's real name, PhD program, and university affiliation (information systems PhD student, university name) in the description field. We also added the first author's geographic location to add authenticity (city, state). The URL in the profile linked to the survey.

We selected the picture for the Twitter account based on three judges' input. The picture is one of the few pieces of a profile that show up next to tweets (in contrast to the follower list, location, etc.). We showed three candid pictures to three judges and asked them which photo would convince them more to take an academic survey. We asked them to pick a friendly, academic, and sincere picture. All three judges chose the same picture, which we used for the account.

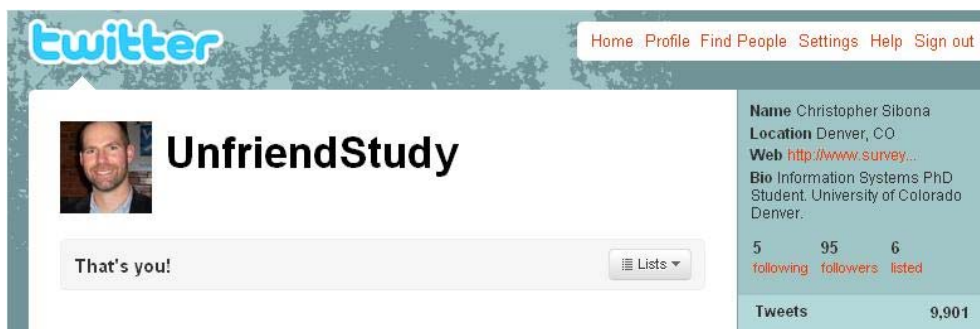


Figure 1. Twitter Profile

4.2 Example from Case Study on Screening Public Tweets

The survey we conducted for our case study focused on why Facebook users choose to unfriend others. We screened tweets by using three related search terms: unfriend, unfriending, and defriend. We used these three terms because a common standard term for unfriending does not exist, and people in different geographical areas prefer different terms. For example, In the United States, people more commonly use unfriend, whereas, in Britain, people more commonly use defriend. Both terms have the same meaning.

The New Oxford American Dictionary defines unfriend as: “to remove someone as a ‘friend’ on a social networking site such as Facebook”.

We screened tweets before the start of the survey to determine whether Twitter would be suitable for recruiting participants. The Twitter community discussed the topic of interest (i.e., unfriending) often enough to provide a viable sample. On average, we sent 48 recruitment tweets sent per day to Twitter users after the screening process. Of the 48 recruitment tweets, on average, 19 survey respondents started the survey and ten completed it. On average, we also sent 18 non-recruitment tweets each day in which we answered questions about the survey or the research. We modeled our recruitment tweets on Dillman et al.’s (2008) method but adapted them to Twitter’s original 140-character limitation since it had not yet introduced the higher character limit when we conducted the study. The recruitment tweet provided enough information to Twitter users to take the survey. Many people throughout the study asked whether real researchers operated the account to ascertain the survey’s veracity. We offered quick replies to indicate that the recruitment was sincere and the research was genuine. We screened and replied to all tweets—we did not use automated messages.

Once we collected relevant tweets, we screened them for additional attributes. We wrote the survey in English, so we only sent requests in response to tweets written in English. Many languages borrow the terms *unfriend*, *unfriending* and *defriend* into their own language, but we did not invite Twitter users writing in different languages to the survey. The survey asked two additional screening questions to determine eligibility. We opened the survey only to Facebook users who were 18 years old or over. We did not provide any monetary incentives to respondents for completing the survey. We told users who asked for the results of the research that the Twitter account would post a link to the research results if a journal accepted the resulting paper for publication.

We screened tweets to determine whether a person discussed unfriending a *person* rather than a TV show, a state, a politician, a celebrity, and so on. For example, some users would tweet things such as “I am going to unfriend American Idol” or “I am going to unfriend the state of Arizona”. We generally avoided recruiting Twitter users who made jokes about unfriending depending on the tweet’s context. Generally speaking, we recruited people with more inclusion than less, but it appeared unhelpful to recruit users who did not talk about defriending a specific person. During the survey, a tweet that others retweeted hundreds of times stated: “Asking me to friend your dog is the same as asking me to unfriend you”. We did not include these retweets in the sample because they did not appear to talk about unfriending a specific person; rather, they represented more of a general sentiment about unfriending and friend requests.

After screening the tweets for inclusion, we sent a recruitment tweet to the user’s Twitter account using the @reply mechanism so the user could see that we responded to a tweet they had sent and could identify it if needed. We sent all recruitment tweets through the @reply mechanism. When users sent a question via Twitter about the recruitment, we promptly replied. The majority of survey respondents did not have a previous relationship with the researcher and did not follow the research Twitter account; thus, the respondent could not use Twitter’s direct message function.

We did not attempt to screen accounts based on how many followers they had, how many profiles they followed, the tweets they sent, or social-influence measures (e.g., Klout.com), nor did we ask users to tweet about the survey or retweet the survey link we sent to them.

4.3 Example from Case Study on Composing Recruitment Tweets

We sometimes varied recruitment tweets we sent in some respects depending on certain factors. The recruitment tweet started with an @reply so that the Twitter user saw the response in their notifications area on Twitter. The message in the second box (see Table 2) differed depending on the language that the original tweet used. So, for example, the recruitment tweet might say either “I saw your tweet about unfriending” or “I saw your tweet about defriending” depending on the user’s phrasing. However, the variations did not always simply restate the original tweet; if someone wrote about the need to unfriend a person, for example, the recruitment tweet would typically say “I saw your tweet about unfriending”. The third box generally remained consistent. The fourth box always included the same long-form URL link to the survey. We occasionally shorted the fifth and sixth boxes, which indicated the importance of the user’s input and the study’s academic nature, generally because some users had long usernames and, at the time we conducted the study, usernames counted as characters. In doing so, we focused on making sure they still conveyed that we valued users’ input (e.g., “Ur input important. PhDRsrchr.”).

We saw the following random sample tweet that exemplifies a typical tweet we saw: “@Y You can always defriend on Facebook, no? You should always have the option of correcting your mistakes. :P”. In response, we sent the following recruitment tweet: “@X I saw your tweet about defriending. I have a survey: <http://www.surveymonkey.com/s/unfriend-t>. Your input very important. PhD stdnt”.

We frequently sent tweets throughout the recruitment process. The first author’s university’s institutional review board (IRB) and the method’s developers did not believe it unduly burdensome to send a single request to a Twitter user requesting survey participation. While one may perceive the total number of recruitment tweets we sent as spam based on the frequency of similar messages to users, Twitter never flagged the account that we used as a spam account. We promptly replied to Twitter users who had questions about the survey and the recruitment as timeliness represents a key cultural convention in using Twitter.

4.4 Example from Case Study on Frequency of Recruitment

We had several concerns about how frequently to send recruitment tweets. We screened tweets regularly during the day (usually every three to five hours) so that, soon after the tweet was posted, the user would receive a survey participation request. If we sent a request immediately after users posted a tweet, they may have believed that we had automated the response and to assume no human involvement. An automated response could also add a random time delay to a response tweet to simulate human behavior; however, since researchers should be prepared to answer questions about the survey from potential survey respondents soon after they send requests to take the survey, we believe human respondents fulfilled this purpose more effectively and did not use any automated response technology for this case study. After sending recruitment tweets, we then reviewed any notifications asking for a response to questions or concerns.

4.5 Examples from Case Study on Post-recruitment Issues and Concerns

The research generated many responses from the potential survey respondents. Many survey respondents had questions about the survey, the researcher, and/or the research (both in terms of why we conducted it and our findings). The topic seemed to pique the interest of many survey request recipients. We were surprised by the number of respondents that thanked us given the length of the survey (on average, respondents took 18 minutes to complete the survey).

People also wanted to know if a real person was conducting the survey, and they often asked questions in a particular way to find out. Though researchers made every effort to indicate that a real person was conducting the account and the tweets, during the recruitment period, one person expressed anger at receiving a tweet from what they perceived to be a robot. The researchers continued to engage the person for some time. Though we did not convince the user enough to take the survey, they appeared to believe that a real person was conducting the study.

Some people receiving the recruitment tweet would retweet it on their own volition; when users occasionally asked whether they could or should retweet or post about the survey, we granted them permission. However, such retweeting occurred relatively rarely—out of 7,327 recruitment tweets sent, 63 people (< 1%) retweeted the survey recruitment, and 39 people sent their own tweet (i.e., did not use the retweet mechanism that Twitter provided) to tell their followers that we were conducting a survey about unfriending and posted the link to the survey.

Some survey respondents wanted to add more context or a more qualitative component than they felt the survey captured and sent us messages along these lines. Such conversations could lead to new areas of research. For example, many people also wanted to understand issues about blocking and hiding users on the platform. Generally, the conversations lasted only briefly, but future researchers using Twitter should be prepared to sufficiently answer such questions.

5 Discussion

5.1 Recruitment Performance

Our findings indicate several advantages in using Twitter to recruit participants for surveys. Twitter offers an extensive pool of potential survey participants who engage in topics of potential research in real time. Twitter makes it possible for researchers to purposively screen potential participants, which gives them

timely access to well-suited survey participants interested in ephemeral topics. Additionally, since Twitter provides a degree of anonymity, researchers may effectively use Twitter to access vulnerable populations that may otherwise not respond to survey requests due to privacy concerns. Since users around the world use Twitter, it also offers researchers the ability to access and compare different populations around the world (see Appendix B).

We found that the direct Twitter recruitment technique we outline here performs better than other online recruitment techniques (see Appendix C and Figure C1). We also found that our personalized Twitter recruitment techniques perform better than automated recruitment techniques (see Appendix C). Furthermore, without the proper motivation, survey respondents may ignore instructions, read questions carelessly, provide incomplete answers, or simply abandon the survey. While self-administered surveys may impose barriers to motivation and completion (Berinsky, Margolis, & Sances, 2014; Dillman et al., 2008), the personalized Twitter recruitment technique that we describe can not only locate motivated individuals currently interested in a targeted research topic but also offer such individuals support to improve their participation and completion rates.

Recruiting on Twitter may also reduce the replicability problems associated with other recruitment methods. For example, two prominent and influential survey studies about Facebook largely used university undergraduates to conduct their research (Acquisti & Gross, 2006; Ellison, Steinfield, & Lampe, 2007). Ellison et al. (2007) clearly indicate that the sample population of university undergraduates used for their study on social capital and Facebook lacked representativeness. For their study on imagined communities and social networking sites, Acquisti and Gross (2006) largely recruited through fliers posted on campus and undergraduate students that indicated interest in participating in experimental studies. Dwyer, Hiltz, and Passerini (2007) used ad hoc methods based on Facebook posts and public forum posts for their study on trust and privacy on two social networking sites. These recruiting approaches introduce potential problems related to replicability because other researchers who may not have access to these specific populations may be unable to replicate the results using other study subjects. Since virtually any researcher can access Twitter subjects, the guide we develop offers a replicable design that researchers can use to recruit subjects in subsequent replication studies.

Our Twitter research method may also reduce non-response bias. Screening techniques can locate users currently interested in study topics. Recruiting people to a survey about a given topic shortly after they have posted about the topic will likely increase the participation rate. Many people who receive survey and would not respond to a request to take a survey under normal conditions may be more willing to participate in a survey after recently tweeting about the topic, which may explain why we found greater participation rates from Twitter recruitment than other methods (see Appendix C).

While, recruitment through Twitter clearly cannot replace probability-based sampling techniques and while researchers will need to follow-up their initial Twitter studies with better (and, likely, more expensive and time-consuming) probability samples, recruitment through Twitter may be appropriate for many research questions that examine users' behavior or for research based on understanding emerging technology and social norms. In short, one can recruit survey participants via many modes, and Twitter may be a viable alternative to more complex, more time-consuming, or more costly methods and have certain potential replicability advantages. Furthermore, researchers may find nonprobability samples helpful for understanding a current phenomenon in an exploratory manner (Cooper & Schindler, 2008), and Twitter recruiting techniques may be a useful tool for exploratory research devoted to understanding emerging phenomena.

5.2 Coverage Errors

While recruiting survey respondents through Twitter proved highly effective for the research we conducted, it has certain limitations. We conducted the case study survey using purposive sampling, a nonprobability sampling technique. We did not personally know the Twitter users, and we recruited Twitter users based on objective screening criteria rather than on other profile measures. Probability-based sampling techniques mean that subjects have a nonzero chance for researchers to recruit them to a sample, but that does not apply with purposive sampling (Cooper & Schindler, 2008). As we discuss above, we believe that our technique will reduce nonresponse bias. However, though a researcher might get a large sample using our Twitter recruitment technique, this technique does not provide any information about nonrespondents. All social media purposive sampling methods have this limitation. However, the Twitter recruitment method that we present in this paper gives researchers a wider reach

without the implicit bias involved in using, for example, “celebrity” influencers’ retweets as a recruitment method.

The technique may also have coverage errors due to the non-observational gap between the Twitter target population and the sampling frame for populations outside Twitter (Dillman et al., 2014; Groves et al., 2004). We found that that 97.1 percent of the people we recruited from Twitter for our study had a Facebook account, but we do not know, for example, how many Facebook users do not have a Twitter account. We also found that 88.7 percent of people we recruited had unfriended someone on Facebook, whereas the Pew Internet Research Group found that only 56 percent of social network users had unfriended someone based on the probability sampling techniques it used (Madden & Smith, 2010). However, we based our survey-recruitment effort on tweets about unfriending, so we can expect that the two statistics (88.7% vs. 56%) would differ. We did not attempt to generalize the survey results concerning the percentage of Facebook users who unfriended someone to the general population. We conducted our analysis only on survey respondents who did unfriend; thus, we did not rely on the general population statistic in our research. One can use statistical weighting methods to compensate for nonresponse and noncoverage issues in the sample (Kalton & Flores-Cervantes, 2003). Appendix A shows the case study sample population versus the known Facebook population that we obtained with the purposive sampling technique that we present in this paper. When the sampling frame misses the target population partially or entirely, researchers can either: 1) redefine the target population to fit the frame better or 2) admit the possibility of coverage gaps in statistics describing the original population (Groves et al., 2004).

The coverage issues we experienced in the case study justified a compromise in coverage due to the exploratory nature of the research. In the case study, we focused on a social networking topic; thus, we can reasonably assume that the population of interest would have access to computers or smart phones and various social networking sites. However, for more general research topics, Twitter recruitment has one limitation in that it only reaches individuals who have both some form of Internet access and Twitter access and may, therefore, not apply to elderly populations or to more economically disadvantaged populations (Andrews, 2012).

The sample population and the population at large should be reasonably similar for the survey results to be believable. If researchers conduct too many surveys on Twitter, the population may become fatigued and not participate in future research (Dillman et al., 2014). Research topics will likely increase interest or decrease interest based on saliency. Twitter users will likely participate in online social networks more than other groups and take surveys such as ours as compared to other topics. As always, survey design and question design constitute important factors in nonresponse bias that researchers must carefully consider for the population (Dillman et al., 2014; Groves et al., 2004). Individuals may have multiple Twitter accounts or have numerous fraudulent accounts that they could use to bias research outcomes (Thomas, McCoy, Grier, Kolcz, & Paxson, 2013), and we need research that focuses on how we can detect these types of accounts.

Morstatter et al. (2013) note that the various APIs that Twitter provides also contain bias. The Streaming API and Twitter’s Firehose may result in researchers accepting a different set of tweets into their sample and lead to coverage concerns. The Streaming API provides a sample of tweets based on Twitter’s criteria, whereas Firehose data delivers a complete set. Salganik (2017) recommends that researchers use post-stratification techniques (which use additional information about group size) to correct imbalances in non-probability samples. In this way, researchers can develop homogenous groups such that they minimize response biases between them. Researchers can estimate coverage errors by collecting additional data either before or after they conduct a survey to help correct sampling coverage errors through post-stratification. Researchers cannot assess coverage errors based on initial census data alone (Wolter, 1986). We recommend that researchers use post-stratification techniques to reduce coverage error bias in cases with known population characteristics.

Researchers also cannot precisely locate a survey respondent’s location using an Internet protocol (IP) address since it works better in some countries (US) than others (Poese, Uhlig, Kaafar, Donnet, & Gueye, 2011). Various things can obfuscate IP addresses, such as virtual private networks. Poese et al. (2011) state that IP-based geolocation is generally accurate at the country level but less so at more granular levels (such as the city level).

5.3 Ethical Considerations

Another limitation involves access to protected populations and ethical considerations. We largely lack regulatory guidelines for how to use social networks such as Twitter, and IRBs may have a difficult time determining necessary steps for compliance (Gelinas et al., 2017). Gelinas et al. (2017) provide some general principles: respect the privacy of and be transparent with users/participants. In their guide, Gelinas et al. (2017) focus on active recruitment (interaction to enroll participants) versus passive recruitment (ads, flyers, posters). Researchers should handle recruitment like recruitment in other contexts where guidance for the non-computer mediated environment applies (Gelinas et al., 2017). Social media users may not inhibit what they post on social network sites because they may not understand how easily others can view their posts, not understand these sites' privacy policies, and not realize how easily one can trace information back to them. Researchers have a duty to honestly describe the aims, details, risks, and benefits of the studies they conduct to potential participants (Gelinas et al., 2017).

The Association of Internet Researchers (AOIR) provides a guide for ethical decision making and Internet research (Markham & Buchanan, 2012). The AOIR guide provides six principles that researchers should follow when conducting research on social networking sites. Researchers must adapt the principles in the guide to the context of a given research study. The first guideline states that the more vulnerable the population, the larger the obligation that researchers have to protect it. Harm is defined contextually. Researchers need to take care because behavioral research focuses on humans even when one cannot immediately recognize how. Researchers must strike a balance between subjects' rights and their research. They must make ethical decisions at all research stages and in consultation with various people, resources, and guidelines. They must handle vulnerable populations and minors with care. Researchers also need to pay attention to tracking users on sites and determining how they can identify minors when they do not require participants to provide demographic information (Markham & Buchanan, 2012). Minors would need parental or guardian consent, and the consent process itself could be problematic (Markham & Buchanan, 2012). It falls outside our scope here to fully discuss the ethical considerations of conducting research on social networking sites.

6 Conclusion

Recruiting survey participants on Twitter represents a useful method for gaining insight into users' behaviors. One can use various modes to conduct survey research, such as by phone, email, and printed mail. Twitter may be a viable alternative to these more established approaches. Recruiting on Twitter includes many advantages, such as the ability to quickly locate participants who have recently experienced an event of research interest, the platform's global reach and potential access to difficult-to-reach populations, lower research costs, and the ability to quickly implement surveys (Andrews, 2012). In this paper, we provide specific guidance for researchers on how to conduct Twitter survey research. We offer detailed information on 1) creating an effective Twitter profile, 2) screening public tweets, 3) composing tweets for recruitment, 4) determining how frequently to send any subsequent recruitment tweets, and 5) navigating post-recruitment questions, issues, and concerns that researchers may encounter. Subsequently, we present a case study in which we implemented the technique in the real world. We also discuss potential solutions for common issues researchers might encounter when using Twitter to recruit subjects. We target the guidelines we present in this paper primarily at academic and corporate researchers. Practitioners performing research-like studies may also use these guidelines; examples include individuals or groups focusing on market research, human resources research, or education research.

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Appendix A

Researchers can compare their demographic samples to the known population to make statistical weighting adjustments to reflect the known population. We show the case study sample categories and known population sample below.

Table A1. Comparison of Known Distribution to Sample

| Collected by study | | | External comparison group |
|--------------------------------------|-------|---------|---------------------------|
| Category | N | Valid % | US Facebook Users % |
| Age (Morrison, 2010) | | | |
| 13-17 | | | 10 |
| 18-25 | 343 | 22.2 | 29 |
| 26-34 | 663 | 42.9 | 23 |
| 35-44 | 397 | 25.7 | 18 |
| 45-54 | 113 | 7.3 | 13 |
| >55 | 28 | 1.8 | 7 |
| Gender (Adweek, 2010) | | | |
| M | 493 | 31.9 | 44.5 |
| F | 1051 | 68.1 | 55.5 |
| Live in the US (Saleem, 2010) | | | |
| Yes | 1,075 | 69.6 | 30 |
| No | 469 | 30.4 | 70 |

Appendix B

Geographical Distribution of Survey Respondents

Due to its international presence, Twitter may offer researchers an opportunity to more easily reach geographically diverse audiences, which could potentially reveal how different populations feel about a given topic. In Figures B1 and B2, we show where survey respondents came from in the US and the world, respectively, based on their IP address.



Figure B1. Survey Respondents from the United States of America



Figure B2. World Map of Survey Respondents

Appendix C

Direct Twitter Recruitment Compared to Facebook Recruiting, Self-Selection, and Retweeting

In order to contextualize the efficacy of using Twitter recruit survey participants, we expanded our recruitment efforts using other online mechanisms. For each type of recruitment, we used the same topic—unfriending on Facebook. We recruited participants according to the following four methods: 1) we recruited participants on Twitter using the method for the research that we describe in this paper; 2) we recruited participants on Facebook during the survey pretest, 3) we recruited Internet users who found the survey through no direct intervention, and 4) we recruited participants on Twitter by relying on an influential Twitter user to retweet our recruitment message. In October, 2010, one month after we finished recruiting for our survey, Twitter had 160 million users, which yielded a large pool of potential survey respondents (Miller & Vega, 2010). Table C1 summarizes the results. For illustrative purposes in this paper, we compare the four techniques we used and demonstrate where using Twitter recruitment offered a significant improvement over the other three techniques.

Table C1. Comparison of Four Recruitment Methods

| | Method 1 | Method 2 | Method 3 | Method 4 |
|-------------------------------------|----------|--------------------|-----------------------------|-------------------------------------|
| | Twitter | Facebook (pretest) | Self-selected survey takers | Retweet by influential Twitter user |
| Recruitment | 7,327 | 1,305 (reach) | 330 | 9,000 (reach) |
| Surveys started | 2,865 | 135 | 330 | 34 |
| Surveys completed | 1,544 | 91 | 23 | 19 |
| Completion rate | 21.3% | 7.0% | 7.0% | 0.2% |
| Start rate | 39.6% | 10.3% | N/A | 0.4% |
| Completion by those who started | 53.9% | 67.4% | 7.0% | 54.3% |
| Breakoff rate | 46.1% | 32.6% | 93% | 45.7% |
| # days | 151 | 85 | 193 | 2 |
| Recruitment tweets sent per day | 47.9 | N/A | N/A | N/A |
| Non-recruitment tweets sent per day | 17.6% | N/A | N/A | N/A |
| Surveys started per day | 19.0 | 1.6 | 1.7 | 35 |
| Surveys completed per day | 10.2 | 1.1 | 0.1 | 19 |

For the second method, we used a convenience sample by posting to five different Facebook profiles and asking friends to participate in the research. We estimated the Facebook recruitment to have reached 1,305 people based on the number of friends the profiles had at the time we conducted the recruitment post. We do not know how many Facebook users actually saw the recruitment posts. When we conducted this recruitment, we found that some participants had a difficult time remembering a specific person whom they had unfriended (the context of the study) because they had not done so recently even though they could remember that they had unfriended someone. We also found participants who lacked interest in the topic in general because they did not have any particular feeling about it.

For the third method, we relied on self-selected survey takers who took the survey on their own; we did not directly contact these participants in any way. Twitter recruitment ended on 15 September, 2010, and the University of Colorado Denver posted a press-release announcing the results on 5 October, 2010, which attracted subsequent media attention to the study. This media attention likely stimulated Web searches on “unfriending” or the first researcher’s name, which led users to the survey. In any case, 330 people took the survey after 15 September, 2010. These self-selected survey takers had a very high breakoff rate (93% failed to complete the survey).

Retweeting research participant recruitment requests represents a powerful tool that can rapidly expand the potential reach and ultimate population that researchers invite to participate in a survey (Lee, Mahmud, Chen, Zhou, & Nichols, 2014). In the fourth method, one influential person (Klout.com score of 67; Klout scores range from 1 to 100) with approximately 9,000 Twitter followers and who posts about

social media retweeted the survey link. Approximately 34 people started the survey based on the retweet, and 19 people completed it (about 54.3%), close to the average of the survey through the @reply mechanism (54.2%). Overall, only about 0.4 percent of this influential person's Twitter followers responded to the survey. Those who did respond had about the same breakoff rate as those who the first author individually recruited. We monitored the survey site for two days to see we could find an uptick in the number of people finding the survey or any effect on completion rates, but the peak of incoming surveys occurred within five hours of the influential person's tweet. In other words, we saw a short-term increase in survey users who completed the survey (19), but it seems unlikely that one person's tweet would have a long-term increase in survey recruitment effort like the one we conducted.

Direct Twitter Recruitment Compared to Automated Recruitment

In our case study, we used purposive sampling on Twitter to recruit participants for an online social network site survey on unfriending—a topic that converged with social media users' activities on Twitter. We found an improved response rate compared to, for example, the automated recruitment techniques that Vaccari et al. (2016) and the ad hoc methods that Gu et al. (2016) used. Vaccari (2016) used automated recruitment for their political survey, and approximately four percent of individuals who received the survey request completed at least half of it. Gu et al. (2016) studied social media recruitment methods and reported responses from approximately 2.5 percent of their automated Twitter recruitment requests. In contrast, in our case study, approximately 39.6 percent of users who received recruitment tweets started the survey, and 21.3 percent of survey participants completed it.

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